CLAIMS

What is claimed is:

1. A valve comprising:

a support element including a longitudinally extending flow path, at least a portion of the flow path extending along an axis of fluid flow;

a flexible element having an open state wherein the flow path is open, the flexible element deformable to a closed state wherein the flexible element interrupts the flow path to at least partially restrict fluid flow through the flow path; and

an actuating element having a position wherein the flexible element is at the open state, the actuating element movable along the axis of fluid flow to another position wherein the actuating element deforms the flexible element to the closed state.

2. The valve of claim 1, further comprising a biasing element to bias the actuating element towards said another position.

3. The valve of claim 1, further comprising a generally cylindrical housing to encase the support element, the flexible element, and the actuating element, the cylindrical housing having an axis substantially concentric with the axis of fluid flow.

4. A valve comprising:

means for providing a longitudinally extending flow path, at least a portion of the flow path extending along an axis of fluid flow;

means for interrupting the flow path, the means for interrupting having an open state wherein the flow path is open, the means for interrupting deformable to a closed state wherein the means for interrupting interrupts the flow path to at least partially restrict fluid flow through the flow path; and

means for deforming, the means for deforming having a position wherein the means for interrupting is at the open state, the means for deforming movable along the axis of fluid flow to another position wherein the means for deforming deforms the means for interrupting to the closed state.

5. The valve of claim 4, further comprising means for biasing the means for deforming towards said another position.

6. The valve of claim 4, further comprising means for housing the means for interrupting, the means for deforming, and the means providing a longitudinally extending flow path.

7. A valve comprising:

a cylindrical housing;

a generally cylindrical support element disposed within the housing, the support element having a first end extending longitudinally to an opposing second end, the support element including a first channel extending from the first end towards the second end and terminating at a first port opening onto an outer surface of the support element, the support element further including a second channel extending from the second end towards the first end and terminating at a second port opening onto the outer surface;

a tubular flexible sleeve disposed within the housing and having one end coupled with the outer surface of the support element, the flexible sleeve extending over the first port and the second port to an opposing end coupled with the outer surface of the support element, an interior surface of the flexible sleeve and the outer surface of the support element bounding an annular region in fluid communication with each of the first and second ports;

a piston disposed within the housing and having an engagement end and an opposing end, the piston having a position wherein the first port is open, the piston movable to another position wherein the engagement end engages an outer surface of the flexible sleeve in a region proximate the first port and compresses the flexible sleeve against the support element to seal the first port; and

a biasing element engaged with the opposing end of the piston to bias the piston towards said another position.

8. The valve of claim 7, further comprising at least one guide surface disposed on one of the support element and the housing, the at least one guide surface to restrict movement of the piston.

9. The valve of claim 7, further comprising:

a first collar to secure the one end of the flexible sleeve with the support element; and

a second collar to secure the opposing end of the tubular sleeve with the support element.

10. The valve of claim 9, one of the first collar and the second collar comprising an overmolded collar.

11. The valve of claim 9, one of the first collar and the second collar providing a guide surface to restrict movement of the piston.

12. The valve of claim 7, further comprising a working fluid cavity to receive a working fluid, the working fluid cavity in fluid communication with the piston.

13. The valve of claim 12, further comprising a fluid tap in fluid communication with the working fluid cavity for introducing the working fluid into the working fluid cavity.

14. The valve of claim 7, further comprising an expansion element disposed in the flexible sleeve.

15. The valve of claim 14, the expansion element comprising a semi-cylindrical ridge extending about a circumference of the flexible sleeve.

16. The valve of claim 7, further comprising at least one coupling mechanism to couple the engagement end of the piston with the outer surface of the flexible sleeve.

17. The valve of claim 16, the at least one coupling mechanism comprising a pin.

18. The valve of claim 7, further comprising:
a cam surface on the engagement end of the piston; and
a follower surface on the outer surface of the flexible sleeve, the follower surface to slidably engage the cam surface.

19. The valve of claim 7, the biasing element comprising a helical compression spring.

20. The valve of claim 7, wherein the first channel terminates at the first port and at least one other port opening onto the outer surface of the support element.

21. The valve of claim 7, wherein the second channel terminates at the second port and at least one other port opening onto the outer surface of the support element.

22. The valve of claim 7, further comprising a seal element disposed on the interior surface of the flexible element, the seal element located and oriented to engage and seal the first port.

23. The valve of claim 7, the flexible sleeve comprising a fluoropolymer material.

24. The valve of claim 23, the flexible sleeve comprising one of polytetrafluoroethylene (PTFE), perfluoroalkoxy (PFA), and polyvinylidene fluoride (PVDF).

25. A valve comprising:

a support element including a longitudinally extending flow path, at least a portion of the flow path extending along an axis of fluid flow;

a flexible element having an open state wherein the flow path is open, the flexible element deformable to a closed state wherein the flexible element interrupts the flow path to at least partially restrict fluid flow through the flow path;

an actuating element having a position wherein the flexible element is at the open state, the actuating element movable along the axis of fluid flow to another position wherein the actuating element deforms the flexible element to the closed state; and

a coupling mechanism coupling the actuating element with the flexible element, the coupling mechanism to allow the actuating element to deform the flexible element from the closed state to the open state when fluid pressure within the flow path is less than a pressure outside the flow path.

26. The valve of claim 25, the coupling mechanism comprising a pin, the pin coupled with a first mating aperture in the flexible element and further coupled with a second mating aperture in the actuating element.

27. The valve of claim 25, further comprising a cam mechanism slidably coupling the actuating element with the flexible element.

28. The valve of claim 25, further comprising a biasing element to bias the actuating element towards said another position.

29. The valve of claim 25, further comprising a generally cylindrical housing to encase the support element, the flexible element, the actuating element, and the coupling mechanism, the cylindrical housing having an axis substantially concentric with the axis of fluid flow.

30. A method comprising:

providing a flow path interruptible by a flexible element, at least a portion of the flow path extending along an axis of flow; and

moving an actuating element in a first direction along the axis of flow to deform the flexible element and interrupt the flow path.

31. The method of claim 30, further comprising moving the actuating element in the first direction along the axis of flow with a biasing element.

32. The method of claim 30, further comprising moving the actuating element in an opposing, second direction along the axis of flow to open the flow path.

33. A method comprising:

providing a flow path interruptible by a flexible element, at least a portion of the flow path extending along an axis of flow;

moving an actuating element in a first direction along the axis of flow to deform the flexible element and interrupt the flow path; and

moving the actuating element in an opposing, second direction along the axis of flow to open the flow path when fluid pressure within the flow path is less than a pressure outside the flow path.

34. The method of claim 33, further comprising moving the actuating element in the first direction along the axis of flow with a biasing element.